The Maryland Fruit Grower

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WHAT DETERMINES COLOR, SIZE, AND FINISH OF APPLES?

A. Lee Schrader
Head, Horticultural Department
University of Maryland, College Park, Maryland

The factors which influence color, size, and finish are many in number and several of them influence color, size and finish in both indirect or direct ways so that it is often difficult to see all of the picture when one considers the influences which affect the final product which we call an apple. Weather conditions might be called to account for their effect upon color, as well as size and finish without an attempt to determine just what influence may be ascribed to any particular weather condition. In some years dry weather may be blamed for poor color and poor size, not to mention finish. In another year high temperatures or hot weather might be considered the prime factor in determining size, color, and finish.

In addition to the weather conditions we must look into the situation to determine what other factors are involved which might influence the development of the fruit.

The fruit must be considered as a growing structure connected with other growing structures on the tree and dependent for its development upon the same things that determine the growth and development of other parts of the tree. Some special materials may be formed to give us what we call color and finish but these materials also are the result of conditions which determine growth and development. If we were to list the various factors which influence color, size, and finish, they might include the following: (1) orchard location, (2) over-load of fruit, (3) light, both intensity and duration, (4) mineral nutrients, including nitrogen, phosphorus, potassium, and other elements, (5) soil moisture available to the tree, (6) spray applications, (7) soil culture, (8) growth conditions of the tree, (9) leaf area for each fruit, (10) variety of fruit, (11) pruning, (12) thinning of fruit, (13) weather conditions including temperature, humidity, sunshine, fogs, etc., and (14) mechanical factors, such as wind or other agencies.

To discuss all of these factors would mean a very long story but it is apparent that all of these influence the development of color, size, and finish, and it is necessary for any grower to recognize the existence of such factors in determining some of the practices which he might put into effect to influence color, size, and finish. It is apparent that we cannot do much to change the weather conditions, but it is possible to avoid some orchard practices which would have an unfavorable influence on the fruit development during certain weather conditions. As one illustration, lime-sulphur burn occurs when spray is applied at high temperatures, usually 82°F. Bordeaux russet is another type of injury which is particularly evident when spray material dries slowly.

A grower can avoid the low, humid parts of his orchard when spraying with Bordeaux in early morning hours or late evening hours. Wind breaks may be important in some sections where wind will carry dust particles with sufficient force to cause mechanical injury to the fruits, as well as causing limb rubs. Air movement (wind) recently has been shown very important as a factor governing fruit growth, probably in its effect on transpiration.*

Irrigation, of course, is a means of adding moisture to the soil to avoid any periods of water deficiency which would markedly influence the color, size, and finish. Adding mulch material to the orchard to prevent loss of soil moisture through run-off and evaporation, has been found quite effective in controlling the moisture factor. In some mulching work on Stayman trees in Maryland it was found that a much better wax development occurred on the fruits with a resultant better finish.

Light conditions surrounding each fruit are very important and the grower must realize that both pruning and thinning of the fruits have an important effect in giving better light conditions for the developing fruits. A fruit produced under shady conditions has a poor chance of developing color, size, or finish. In work at the Maryland Experiment Station, reducing the light below 40 percent of normal, entirely prevented the development of color and caused decrease in size.

All of the discussion of weather conditions thus shows that the grower has some means at his disposal to give the fruits a better chance to develop.

In the nutrition of the tree, aside from the soil moisture question, the grower has an excellent chance to increase color, size, and finish. The proper use of fertilizers to add mineral nutrients to the soil thus promoting the development of the foliage and growth of the tree upon which the development of the fruit depends, is one which needs careful consideration.

Improper use of such fertilizers, especially in relation to other orchard practices, may lead to poor development of color, size and finish too often experienced by growers. The growth condition of the tree offers the best means of diagnosis in determining the fertilizer needs of the tree. There can be no blanket recommendation to cover all conditions even within a given orchard. The variety needs to be considered in its response to the fertilizers so that each variety will be given the optimum development of tree and foliage. Experiments have shown that each variety has a different leaf area requirement per fruit to develop best color and size.

In stimulating the growth of a tree by use of fertilizers it is often overlooked that fruit bud formation, as well as the set of fruit, is increased. If a very heavy set of fruit occurs, we have what is called an "overload" of fruit which will be disastrous to development of color, size, and finish, in spite of the growth condition of the tree. If a grower fails to recognize an overload of fruit he is bound to obtain a large quantity of under-sized fruit of poor color and finish. Too few leaves per fruit is the reason for such results.

A further consideration of importance is the effect of poor color, and finish on the storage behavior of apples. If apples are russeted, the water loss from fruit is much more rapid and apples will shrivel in storage. This result was very marked on some Grimes and Delicious apples in 1935. Apples which have developed a poor quality of color or a small amount of color also have poor keeping quality, which seems to be related to the amount of wax development on such fruits. Poor wax development on poorly colored fruits would mean a more rapid loss of water and early shriveling.

* Harley, C. P. Unpublished Manuscript.

Without further detailed discussion of the factors which determine color, size and finish, it seems important to point out all of the practices which have been found by investigational work to be of assistance to the grower in the development of color, size, and finish. These practices can be listed as follows:

1. Thinning of fruits. (Remove cull and inside fruits especially.)
2. Pruning. (Detail cuts to remove weak wood.)
3. Propping. (To open branches to light where load is heavy.)
4. Fall nitrogen applications. (Better color and earlier maturity.)
5. Avoiding spring nitrogen of slow availability. (Delayed maturity and less color.)
6. Mulching. (Moisture conservation for better color, size, and finish.)
7. Irrigation. (A possibility used by some growers in the East.)
8. Spot-picking. (A real benefit to improve color and size.)
9. Keeping healthy foliage. (Leaf area makes color, size and finish.)
10. No spraying with Bordeaux at low temperatures. (Reduces russet.)
11. No spraying when spray does not dry quickly. (Reduces burn and russet.)
12. Planting varieties adapted to soil and region. (A first requisite.)
13. Keeping tree growing well. (A fruit grows as the tree grows.)
14. Cover crops. (The soil improvement may be a deciding factor.)
15. Adequate tree spacing. (A tree may be "pot-bound" in later years.)

This brief review of the factors influencing color, size, and finish is intended to present the entire story without attempting to go into detail, making it possible for a grower to consider all the factors which may be influencing the development of his crop.

THINNING

Each year the old topic of thinning is "dusted off," and discussed. This is an old orchard practice, and has all sorts of variations. It has undergone many changes, but the principle is the same. The benefits of thinning are given as:—affecting better size; better color; easier spray coverage; desirable

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effect upon next season's bud set; less breakage; removal of cull fruits. Distance of thinning was formerly given as 6 to 8 inches for apples; and 4 to 10 inches for peaches depending upon early or late variety, tree vigor, etc. Some growers thinned so that peaches were "two fists" apart. Now, the instructions are to thin apples so that there will be 40 to 50 leaves per fruit, and peaches 20 to 30 leaves per fruit. That doesn't mean to actually count the leaves, but helps in figuring out thinning distance or degree.

With all of these guides, it still remains for the individual grower to figure out his own thinning practice. Some growers prefer propping, with only enough thinning to remove cull fruit, or to break heavy clusters and "ropes." Some want small fruit for export. Others thin hard for size. With prospects of a heavy crop, this year the growers have been told that it was essential to thin fruit early, adequately, carefully, and thoroughly. After all is said, it still rests with the individual grower as what degree of thinning he will use in his own orchard.

JAP BEETLE AND FRUIT INJURY

Fortunately, the Japanese beetle has not done serious damage in Maryland orchards. But it is working in Maryland, and nobody knows when it may break loose, nor how much damage it may do. It can do plenty of damage if conditions are right. Circular 366, entitled "Japanese Beetle Control in Commercial Fruit Plantings," issued by New Jersey Agricultural Experiment Station, New Brunswick, should be of interest to growers of apples, peaches, cherries, plums, grapes, cane fruits, and strawberries, if these growers are located near infested areas.

BE CAREFUL

In all this discussion about arsenate of lead residue, we have forgotten the man on the spray rig. According to "Wisconsin Horticulture", Prof. C. L. Fluke, Entomologist of Wisconsin, advises growers to avoid breathing lead arsenate dust as the tank is being filled, and figures that one can breathe as much arsenate dust in a day as is found on 100 bushels of sprayed apples. Be careful.

ANNUAL PROCEEDINGS

The Proceedings of the Thirty-ninth Annual Meeting of the Maryland State Horticultural Society, held at Hagerstown, in January, have been mailed to paid up members. Mistakes may occur and things may get lost in the mail. If your membership for 1937 has been paid, and Proceedings not received, please write A. F. Vierheller, College Park. Membership is one dollar a year. We want more active membership. Won't you do your part? Cash, check or money order will put you in good standing.

ZINC SULFATE

Illinois Bulletin 424, entitled "Further Studies on Zinc Sulfate in Peach Sprays" published by Illinois Experiment Station, Urbana, discusses use of zinc sulphate in peach and apple sprays. The authors, K. J. Kadow and H. W. Anderson, conclude: that zinc sulfate reduces spray injury on peach where acid lead arsenate and lime are used. Smaller amounts of zinc sulfate

seem to be as effective as larger amounts, in reducing this spray injury. Under average conditions, 1 pound of zinc sulfate in a 100-gallon tank of water, with 3 pounds of acid lead arsenate, and 3 pounds of hydrated lime reduced spray injury effectively under average field conditions. Evidently, zinc sulfate had no marked effect in codling moth control on apples. Use of 8 pounds of zinc sulphate per 100 gallons of spray material containing lead and lime, caused russeting of Ben Davis apples, and Bordeaux containing 4 to 5 pounds of copper sulfate also caused russet. Effect of small amounts of zinc sulfate in apple sprays was not determined. Laboratory tests showed that zinc sulfate was more effective against apple scab than against peach brown rot. However, field tests showed only 65% control of apple scab with this material. In general, the use of zinc sulfate as a disease control material was not recommended. Where soluble zinc is lacking in the soil, zinc sulfate may cause deeper leaf color in the peach trees.

COLD STORAGE HOLDINGS

The May 1 cold storage holdings of apples as reported by U. S. Bureau of Agricultural Economics is as follows:

	May, 1936	April, 1937	May, 1937
Barrels	86,000	42,000	14,000
Western boxes	2,946,000	4,580,000	2,263,000
Bushel baskets, Eastern boxes or crates	2,146,000	2,654,000	1,228,000

In "Wisconsin Horticulture", it is stated that a bacteriologist says that a germ can live a year on a dollar bill. A germ is economical and conservative. He doesn't wear clothes, smoke cigars, bet on races, play bridge, own an auto, join the Elks, play golf, or try to keep up with the Joneses.

SPRAY RESIDUE TOLERANCE

Again the fruit growers are reminded that the spray residue tolerance per pound of fruit will be .018 grains of lead, and 0.01 grains of arsenic (as arsenic trioxide) and the same for flourine. These are the same as last year, and will be in effect until further notice.

CODLING MOTH BANDS

The entomologists recommend that codling moth bands be placed about the apple tree trunks before June 15th. To be of any value, the loose bark must be scraped from the trunks, for the idea of tree bands is that the young worms will look for rough or sheltered places in which to spin up their cocoons. With the bark scraped off, the bands will be about the only rough, sheltered spots to be found, and the worms will crawl under the bands.

In February 1937 "Virginia Fruit" A. M. Woodside, Entomologist, gives some figures covering investigations made with tree bands. Assuming the cost of treated bands as $2.25 per 250 feet roll, and labor at $1.25 per day, the figures show that in four years' trial, the cost of destroying 100 worms under bands ranged from $5.57 to $34.46, depending upon the infestation.

The more worms, the less cost to kill off large numbers. The average cost per tree, for banding, ranged from 3.5c to 3.8c. Various types of bands were tested, and in general the commercial bands were better than the home-made ones, due to more even coating. While bands with 0.4 oz. of beta naphthol per foot were effective, this was considered on the border-line. The usual recommendations are ¾ oz. of beta naphthol per foot of band, two inches wide. On the basis of cost, home-made bands are not advisable.

The March, 1937 "Tennessee Horticulture" has summarized the results of Pennsylvania Bulletin 330, by H. N. Worthley and L. C. Marston, Jr. Briefly, the conclusions and finds of these investigators were: 1. The most efficient mixture was Cod-Ban, two pounds in one pint of plain white gasoline. 2. Single dipping, immersing rolls flat-wise to ¾ of the band depth, and reversing the procedure, was more efficient than single or double dipping when the whole roll was immersed. 3. Home dipping is not recommended unless 4,500 feet of roll is required. It costs 30c less to make 250 feet of band, than to buy it. 4. Bands should not be placed on trees too early, as they will weather out. 5. The use of butter tub staples for nailing bands to trees is better than use of nails through the bands. The nails cut the bands, and also may cause injury by allowing the chemical to enter the tree through the nail holes. 6. Bands should be removed and burned about 2 weeks after harvest, or later if there are many drops. 7. To avoid injury, bands should be placed higher or lower on the tree trunks, in succeeding years.

STRAW MULCH

It is agreed that mulching of trees is a good practice, if straw is cheap enough. Of course, there are hazards in use of straw, among these being danger of fire, and possibly increased injury by mice.

In April, 1937, News Letter of Illinois State Horticultural Society, C. L. Burkholder of Purdue Experiment Station, considers the fertilizer value of straw, aside from its mulching value, in moisture-saving. His figures follow:

Fertilizer Value per Ton of Straw. 1937.

	Nitrogen* (pounds)	Phosphoric Acid* (pounds)	Potash* (pounds)	Ton Value† (dollars)
Wheat	10	3	15	1.67
Oats	12	4	30	2.74
Rye	9.3	5.3	16	1.82

* Henry—"Feeds and Feeding."

† Nitrogen 6c, Phosphorus acid 5⅝c, Potash 6c per pound based on cost of plant food in mixed fertilizers.

He recommends about 2 bales of straw per tree, to start with, and 1 bale each year thereafter. However, one orchard receiving ⅔ of a bale, average per year was showing fine results. Cost of scattering straw ran about 2 to 3 cents per bale. Total costs for straw and scattering, ran about $8.75 per acre (55 trees per acre), but deducting fertilizer value of the straw, the cost would be about $8.41 per acre. These are Indiana figures and will vary in Maryland.

HAVE YOU READ THE ADVERTISEMENTS?

ANNUAL AVERAGE OF FRUIT CONSUMPTION INCREASING

Per capita consumption of all fruits is increasing. This is indicated by an analysis of production during the period 1931-35, the Bureau of Agricultural Economics reports.

Using production figures as an index of consumption the Bureau compared this 5-year period with the 5-year period 1921-25. During the earlier period the per capita production of seven fruits combined was 160 pounds; for the period 1931-35 it was 168 pounds.

The largest increase took place in citrus fruits, which advanced from about 32 pounds per capita for the 1921-25 period to an average of 48 pounds for 1931-35. These 48 pounds included 33 pounds of oranges, 10 pounds of grapefruit, and 5 pounds of lemons.

Apples showed the greatest drop, declining from 66 to 59 pounds. Peaches remained unchanged at 20 pounds. Grapes declined from 34 to 32 pounds and pears increased slightly from about 8 pounds to 9 pounds. Imports of bananas declined from 22 pounds to 20 pounds per capita.

U. S. Dept of Agr. Release—Dec., 1396.

BULLETINS

Spraying Calendar. Extension Bul. 154—1936. Illinois Agr. Extension Service, Urbana, Ill.

Information for Virginia Fruit Growers. Bul. 131—1936. Virginia Extension Division, Blacksburg, Va.

Control of the Plum Curculio in Delaware. Bul. 193—1935. Delaware Agr. Exp. Sta., Newark, Del.

Orchard Soil Management. Bul. 28—1934. Missouri Fruit Exp. Sta., Mountain Grove, Mo.

The Role of Zinc Sulfate in Peach Sprays. Bul. 414—1935. Illinois Agr. Exp. Sta., Urbana, Ill.

Arsenical Injury on the Peach. Technical Bul. 49—1935. North Carolina Agr. Exp. Sta., Raleigh, N. C

Picking, Handling, and Refrigeration of Raspberries and Strawberries. Bul. 318—1935. Minnesota Agr. Exp. Sta., St. Paul, Minn.

Sprays, Their Preparation and Use. Bul. 336—1935. Oregon Agr. Exp. Sta., Corvallis, Oregon.

Further Studies on Zinc Sulphate in Peach Sprays, with Limited Tests in Apple Sprays. Bul. 424—1936. Illinois Agr. Exp. Sta., Urbana, Ill.

Preparation of Bordeaux Mixture with Special Reference to the use of Commercial Hydrated Lime. Circ. 49—1936. New Hampshire Agr. Exp. Sta., Durham, N. H.

Preparing Chemically Treated Bands for Codling Moth Control. Bul. 330—1936. Pennsylvania Agr. Exp. Sta., State College, Pa.

Some Problems in Apple Spraying in Pennsylvania. Bul. 324—1936. Pennsylvania Agr. Exp. Sta., State College, Pa.

Studies on the Adhesiveness of Sulfur Residues on Foliage. Bul. 611—1936. New Jersey Agr. Exp. Sta., New Brunswick, N. J.

The Plum Curculio in Virginia. Bul. 297—1935. Virginia Agr. Exp. Sta., Blacksburg, Va.

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